

# PATENT ABSTRACTS OF JAPAN

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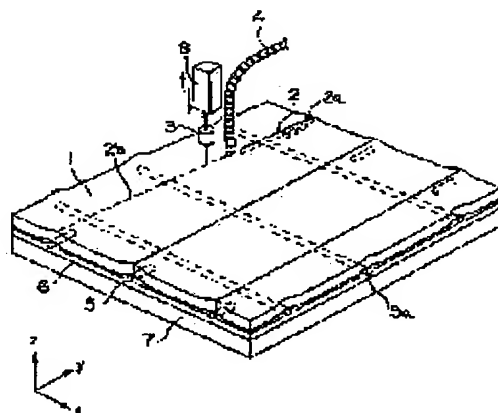
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## (54) METHOD FOR DIVIDING PLATE GLASS AND DEVICE THEREFOR

### (57)Abstract:

**PURPOSE:** To provide a method and device for dividing a plate glass capable or reducing the generation of a glass fine powder at and after dividing and aiming to prevent the divided plane from the generation of micro-cracks by employing a specific means in dividing the plate glass along the projected dividing lines.

**CONSTITUTION:** This method for dividing a plate glass comprises forming a pre-crack 2a becoming a starting point of a dividing line 2 with a dividing tool 3 at the end part of the plate glass 1 on a projected dividing line 2b of the plate glass 1, applying a bending moment around the projected dividing line 2b e.g. by inserting a wedge 5 at the time of or directly after the forming of the pre-crack 2a, then dividing the plate glass 1 by heating the vicinity of the end of the dividing line 2 with a heating means 4 (e.g. a carbon dioxide gas laser) to progress the dividing line 2 on the projected dividing line 2b and also applying the bending moment around the projected dividing line 2b at or just after the progress of the dividing line 2.



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**CLAIMS**

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[Claim(s)]

[Claim 1] While forming the preliminary crack which serves as the starting point of a rate open circuit at the edge of a glass plate on the \*\*\*\* projected line of a glass plate in the \*\*\*\* approach of a glass plate of \*\*\*\*(ing) a glass plate along with a \*\*\*\* projected line With the preliminary crack formation process which adds the bending moment to the surroundings of a \*\*\*\* projected line immediately after the time of formation of a preliminary crack, or formation, subsequently While advancing a rate open circuit and \*\*\*\*(ing) a glass plate on a \*\*\*\* projected line by adding local heating near the edge of a rate open circuit The \*\*\*\* approach of the glass plate characterized by what it had the \*\*\*\* process which adds the bending moment around a \*\*\*\* projected line for during progress of a rate open circuit, or immediately after the progress halt.

[Claim 2] The \*\*\*\* approach of the glass plate according to claim 1 characterized by using carbon dioxide laser or combustion flame as a source of heating heated locally.

[Claim 3] The \*\*\*\* approach of the glass plate according to claim 1 or 2 characterized by carrying out by cutting formation of a preliminary crack with the load of 200 or less gves, and putting in a line.

[Claim 4] The cutting machine of the glass plate characterized by having the cutting tool which forms the preliminary crack used as the starting point of a rate open circuit in a glass plate along with a \*\*\*\* projected line, a heating means to add local heating near the edge of a rate open circuit, the hot-spot migration means, to which relative displacement of a heating means and the glass plate is carried out along with a \*\*\*\* projected line, and a bending moment energization means to give the bending moment to the surroundings of the \*\*\*\* projected line of a glass plate.

[Claim 5] A bending moment energization means is the cutting machine of the glass plate according to claim 4 characterized by consisting of a pressure roll.

[Claim 6] A bending moment energization means is the cutting machine of the glass plate according to claim 4 characterized by consisting of a wedge.

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**DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

[Industrial Application] Especially this invention relates to the \*\*\*\* approach of a glass plate and equipment which cannot generate the fines of glass easily about the \*\*\*\* approach of a glass plate, and equipment.

[0002]

[Description of the Prior Art] After cutting cutting of the former and a glass plate, pressing the cutting wheel which consists of cemented carbide etc. by the fixed load and putting in a line, it bends around an end line and the method of applying and \*\*\*\*(ing) the force (bending moment) is taken.

[0003] In order to make it not produce chip box \*\*\*\* of the kind which a rate open circuit cuts and shifts from a line at this time, in case an end line is put in, it is necessary to add a sufficiently big load. Therefore, the lateral crack which advances to abbreviation parallel on the surface of [ other than the median crack which advances in the thickness direction of a glass plate required for cutting originally ] a glass plate arises in the glass surface section, and since this cuts and it exfoliates after the time of line formation, or \*\*\*\*, generating of glass fines is not avoided.

[0004] These glass fines become the cause which adheres to the installation base of glass etc. and attaches a detailed blemish to a glass front face, and also have the problem of the glass fines adhering to a glass front face damaging a glass front face at the time of washing, or giving a blemish on the surface of a glass plate in case the glass fines which were not able to be removed by washing grind the front face of a glass plate, or when a glass plate is piled up.

[0005]

[Problem(s) to be Solved by the Invention] By the way, the method of producing thermal stress by carbon dioxide laser, and \*\*\*\*(ing) glass as the \*\*\*\* approach which glass fines cannot generate comparatively easily, is learned (F. report by P.Gagliano and R.M.Lumley (Proc.of the IEEE, vol.57, no.2, and 1969)). This is known also as an approach of \*\*\*\*(ing) glass in the configuration of arbitration (Japanese Patent Publication No. No. 13040 [ three to ]).

[0006] However, in case it is necessary to form in the edge of a glass plate the preliminary crack which becomes the origin of \*\*\*\* in case a glass plate is \*\*\*\*(ed) and this preliminary crack is formed also by these approaches, the fines of glass arise. Moreover, apart from it, although it is a slight distance, it leaves a part, \*\*\*\* stops and there is a problem that \*\*\*\* does not reach to the edge of objection of a glass plate. At this time, sufficient dimensional accuracy may not be acquired by having folded the glass plate again and having broken it.

[0007] Drawing 2 is the perspective view of a rate open circuit having shown this situation, and shows signs that the rate open circuit 12 was formed with the preliminary crack 11 as the starting point formed in the edge of a glass plate 1. 13 shows the uncut portion section.

[0008] The object of this invention tends to cancel the above-mentioned fault which a Prior art has.

[0009]

[Means for Solving the Problem] In the \*\*\*\* approach of a glass plate of 1st this invention being made the above-mentioned technical problem being solved, and \*\*\*\*(ing) a glass plate along with a \*\*\*\* projected line While forming the preliminary crack used as the starting point of a rate open circuit in the edge of a glass plate on the \*\*\*\* projected line of a glass plate With the preliminary crack formation

process which adds the bending moment to the surroundings of a \*\*\*\* projected line immediately after the time of formation of a preliminary crack, or formation, subsequently While advancing a rate open circuit and \*\*\*\*(ing) a glass plate on a \*\*\*\* projected line by adding local heating near the edge of a rate open circuit The surroundings of a \*\*\*\* projected line are provided with the \*\*\*\* approach of the glass plate characterized by what it had the \*\*\*\* process which adds the bending moment for during progress of a rate open circuit, or immediately after a progress halt.

[0010] The cutting machine of the glass plate characterized by to have the cutting tool which forms [ 2nd ] the preliminary crack used as the starting point of a rate open circuit in a glass plate along with a \*\*\*\* projected line, a heating means add local heating near the edge of a rate open circuit, the hot-spot migration means, to which relative displacement of a heating means and the glass plate is carried out along with a \*\*\*\* projected line, and a bending moment energization means give the bending moment to the surroundings of the \*\*\*\* projected line of a glass plate is offered.

[0011]

[Function] In this invention, the depth of a preliminary crack can be increased by using the bending moment together to formation of the preliminary crack used as the origin of \*\*\*\*. Therefore, under a very weak load, only by running a cutting tool, a preliminary crack with sufficient deep depth to produce \*\*\*\* can be formed, and generating of glass fines can be controlled in the preliminary crack section.

[0012] Moreover, in order to advance a rate open circuit on a \*\*\*\* projected line by adding local heating near the trailer of a rate open circuit, adding the bending moment to the surroundings of a \*\*\*\* projected line, it is hard to produce an uncut portion of a trailer.

[0013]

[Example] Hereafter, the example of this invention is explained according to a drawing.

[0014] Drawing 1 is the perspective view of the fundamental configuration of this invention.

[0015] The glass plate 1 set as the object of \*\*\*\* is laid on the trolley table 7 through the protection sheet 6 with the function of shock absorbing material in order to protect a glass plate from the impact at the time of glass \*\*\*\*. In this example, a hot spot is moved with a trolley table 7. That is, the heating means 4 is being fixed, and when a trolley table moves in the direction of a \*\*\*\* projected line, a glass plate and a heating means are displaced relatively along with a \*\*\*\* projected line.

[0016] Moreover, the bending moment energization means slack wedge 5 is inserted in the glass plate edge of a location which met the \*\*\*\* projected line between a glass plate 1 and the protection sheet 7. Moreover, since the vacuum adsorption of a trolley table 7 is attained and many holes for attraction are opening it on the protection sheet 6, vacuum adsorption of the glass plate 1 is carried out on the protection sheet 6, and the bending moment which met the \*\*\*\* projected line at the glass plate 1 is added. In addition, the bending moment which met the \*\*\*\* projected line depending on the configuration of a wedge can also be added to a glass plate 1 with the self-weight of a glass plate 1.

[0017] In addition, 2 is a cutting tool support press means which carries out actuation which a rate open circuit and 3 support the cutting tool for formation of a preliminary crack, and 8 supports a cutting tool, and is forced on a glass plate by a diagram.

[0018] Although the trolley table 7 was used as a hot-spot migration means in this example, if relative displacement of a heating means and the glass plate is carried out along with a \*\*\*\* projected line, it is good anything. Especially this example fixes a glass plate 1 to reverse, and may move the heating means 4 to it.

[0019] About the heating means 4, laser light, heating air, combustion flame, etc. can be used by independent or compound. Since a high \*\*\*\* precision is acquired, it is desirable to use laser light or combustion flame, such as an excimer laser, an YAG laser, carbon dioxide gas laser, or a carbon monoxide laser. It is desirable to use carbon dioxide laser or combustion flame especially, energy-absorbing effectiveness and since it is economical.

[0020] In this invention, in order not to shift on a \*\*\*\* projected line and to advance a rate open circuit, it is required to carry out partial heating of near the edge of a rate open circuit. For partial heating, it is desirable to lead the source of heating to a predetermined location, and to perform it. Things can be carried out, and when [ which carries out a light guide according to the optical system which consists of a crystal fiber light guide line, a hollow capillary light guide line, and a lens mirror when laser light is used as a heating means 4 ] using heating air, a heat-resistant tube etc. can draw the source of heating by

the combustion nozzle, a rubber tube, etc., when using combustion flame.

[0021] About the cutting tool 3, the cutter which sharpened heads, such as a single crystal diamond or a sintered diamond, can be used.

[0022] In order to avoid breakage on a glass plate 1, the wedge used as the protection sheet 6 and a bending moment energization means 5 has the desirable thing of organic macromolecule nature, and the PTFE sheet which has thermal resistance especially, a polyimide resin sheet, its fluorine rubber sheet, etc. are desirable.

[0023] A bending moment energization means should just be established near [ which forms a preliminary crack near the preliminary crack formation part at least ] the edge of a glass plate, and the edge (the termination of a rate open circuit near [ namely, ]) of an opposite direction. By drawing 1, the wedge 5 is divided and formed in two places (the termination of a rate open circuit near the preliminary crack formation part). Wedge 5a used on the other hand in case it \*\*\*\* to \*\*\*\* projected line 2b and a perpendicular direction is prepared covering full [ of a glass plate ].

[0024] Next, actuation of the equipment of this example is explained. First, a glass plate 1 is laid through the protection sheet 6 and the wedge 5 of a predetermined location on a trolley table 7, and vacuum adsorption is carried out. Subsequently, in the condition, a part for the cutting part of the cutting tool 3 is forced on a glass plate 1 with the cutting tool support press means 8, and preliminary crack 2a which becomes the starting point of the rate open circuit 2 on \*\*\*\* projected line 2b of the edge of a glass plate 1 is formed. Furthermore, partial heating is carried out near the rate open-circuit termination with the heating means 4. In this way, stress concentration is produced with a rate open circuit and heat on a \*\*\*\* projected line, and the rate open circuit 2 is advanced to \*\*\*\* projected line top 2b. Under the present circumstances, along with a \*\*\*\* projected line, relative displacement of the heating means 4 is carried out to a glass plate 1 with a trolley table 7.

[0025] According to the equipment of this invention, about 20–200 gves of formation of the preliminary crack by the cutting tool 3 can be performed by the weak load of \*\*. It is dramatically desirable to perform preliminary crack formation by this \*\*\*\*\* in the semantics which avoids fines generation of glass. In the above-mentioned example, although the bending moment is simultaneously added at the time of preliminary crack formation, it is after formation of a preliminary crack and the bending moment may be added before partial heating. However, it is more more desirable to form in preliminary crack formation and coincidence in the semantics which shortens the time amount which \*\*\*\* takes.

[0026] In addition, as an approach for making a glass plate 1 generate the bending moment, it is not limited to the approach of this example, but various approaches can be adopted. For example, the approach of performing by pressing down glass with a pressure roll etc. from the rear face or both sides of the approach of generating bending stress, and glass etc. can be used by pressing down both the sides of a wedge with a roll etc.

[0027] Drawing 3 is the side elevation of the pressure roll arrangement at the time of using a pressure roll, and 21–23 show the pressure roll. There is not necessarily no need of preparing all of these pressure rolls, and, as for bending moment addition, at least pressure roll 21 is possible.

[0028] \*\*\*\* was specifically performed as follows. The polyimide resin sheet which prepared the micropore for vacuum attraction in the predetermined part as a protection sheet was pasted up on the trolley table 7 in which vacuum adsorption of 1m angle is possible. Furthermore, as a wedge, the PTFE sheet with die length of 1m, a width of face [ of 1mm ], and a height of 0.2mm was separated from 150mm spacing and both sides 50mm in the x directions, a total of seven trains pasted up, the PTFE sheet with die length of 10mm, a width of face [ of 1mm ], and a height of 0.2mm was separated from 150mm spacing and both sides 50mm only to both ends, and a total of 14 pieces pasted up in the direction of y to them.

[0029] The glass plate with die length of 1m which consists of soda lime glass which performed washing sufficient besides, a width of face [ of 1m ], and a thickness of 0.7mm was carried, vacuum attraction was carried out, and fixed maintenance was carried out. Moving a 3 casks of cutting tools diamond cutter linearly horizontally at the rate of per second 50mm, the cutter was made to go up and down and the end line with a die length of 5mm was put in near the glass edge by about 40g load. By moving the carbon-dioxide-gas-laser beam light which carried out the light guide by the carbon-dioxide-gas-laser hollow capillary light guide line, \*\*\*\* was able to be performed with the above-mentioned end line as the starting point.

[0030] The reinforcement of a carbon-dioxide-gas-laser beam was about 50W in respect of glass. A total of 36 150x150mm glass substrates was obtained by this cutting. Although these substrates were observed under the 200,000 luxs light source all over the dark room, adhesion of the fines of glass was not accepted and the dimensional accuracy of cutting was less than  $\pm 0.1$ mm about the perimeter including an origin and an end.

[0031]

[Effect of the Invention] The following effectiveness is attained by this invention.

[0032] 1) It is obtained, without performing washing with a special glass substrate with little adhesion of glass fines, since there is very little generating of the glass fines after the time of cutting and cutting.

[0033] 2) Since the blemish generated at the polish process of a glass substrate decreases, polish floor to floor time can be shortened.

[0034] 3) Compared with the case where the bending moment is not used together, high-speed cutting is attained by the high yield.

[0035] 4) Since an uncut portion does not arise, cutting of close dimensional accuracy can be performed.

[0036] 5) Since a micro crack does not exist in a cutting plane, the mechanical strength of glass is high, and since washing residue cannot remain easily, it is easy to acquire the clean surface.

[0037] 6) Since grinding fluid etc. does not adhere, it is not necessary to wash glass.

[0038] According to this invention, it can cut with the sufficient yield, without damaging glass also about the thin glass 0.2mm or less which an end line could not put in easily.

[0039] 7) If this invention is used when manufacturing the substrate for liquid crystal display components (LCD) especially, it is very effective. that is, since glass fines hardly arise at the time of \*\*\*\*, a foreign matter can remain on a liquid crystal display component substrate, and the situation which the irregular color which boils and depends an electric short circuit and the fluctuation in a substrate of a liquid crystal bed depth generates can be prevented.

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**TECHNICAL FIELD**

[Industrial Application] Especially this invention relates to the \*\*\*\* approach of a glass plate and equipment which cannot generate the fines of glass easily about the \*\*\*\* approach of a glass plate, and equipment.

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**PRIOR ART**

[Description of the Prior Art] After cutting cutting of the former and a glass plate, pressing the cutting wheel which consists of cemented carbide etc. by the fixed load and putting in a line, it bends around an end line and the method of applying and \*\*\*\*(ing) the force (bending moment) is taken.

[0003] In order to make it not produce chip box \*\*\*\* of the kind which a rate open circuit cuts and shifts from a line at this time, in case an end line is put in, it is necessary to add a sufficiently big load. Therefore, the lateral crack which advances to abbreviation parallel on the surface of [ other than the median crack which advances in the thickness direction of a glass plate required for cutting originally ] a glass plate arises in the glass surface section, and since this cuts and it exfoliates after the time of line formation, or \*\*\*\*, generating of glass fines is not avoided.

[0004] These glass fines become the cause which adheres to the installation base of glass etc. and attaches a detailed blemish to a glass front face, and also have the problem of the glass fines adhering to a glass front face damaging a glass front face at the time of washing, or giving a blemish on the surface of a glass plate in case the glass fines which were not able to be removed by washing grind the front face of a glass plate, or when a glass plate is piled up.

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**EFFECT OF THE INVENTION**

[Effect of the Invention] The following effectiveness is attained by this invention.

[0032] 1) It is obtained, without performing washing with a special glass substrate with little adhesion of glass fines, since there is very little generating of the glass fines after the time of cutting and cutting.

[0033] 2) Since the blemish generated at the polish process of a glass substrate decreases, polish floor to floor time can be shortened.

[0034] 3) Compared with the case where the bending moment is not used together, high-speed cutting is attained by the high yield.

[0035] 4) Since an uncut portion does not arise, cutting of close dimensional accuracy can be performed.

[0036] 5) Since a micro crack does not exist in a cutting plane, the mechanical strength of glass is high, and since washing residue cannot remain easily, it is easy to acquire the clean surface.

[0037] 6) Since grinding fluid etc. does not adhere, it is not necessary to wash glass.

[0038] According to this invention, it can cut with the sufficient yield, without damaging glass also about the thin glass 0.2mm or less which an end line could not put in easily.

[0039] 7) If this invention is used when manufacturing the substrate for liquid crystal display components (LCD) especially, it is very effective. that is, since glass fines hardly arise at the time of \*\*\*, a foreign matter can remain on a liquid crystal display component substrate, and the situation which the irregular color which boils and depends an electric short circuit and the fluctuation in a substrate of a liquid crystal bed depth generates can be prevented.

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**TECHNICAL PROBLEM**

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[0006] However, in case it is necessary to form in the edge of a glass plate the preliminary crack which becomes the origin of \*\*\*\* in case a glass plate is \*\*\*\*(ed) and this preliminary crack is formed also by these approaches, the fines of glass arise. Moreover, apart from it, although it is a slight distance, it leaves a part, \*\*\*\* stops and there is a problem that \*\*\*\* does not reach to the edge of objection of a glass plate. At this time, sufficient dimensional accuracy may not be acquired by having folded the glass plate again and having broken it.

[0007] Drawing 2 is the perspective view of a rate open circuit having shown this situation, and shows signs that the rate open circuit 12 was formed with the preliminary crack 11 as the starting point formed in the edge of a glass plate 1. 13 shows the uncut portion section.

[0008] The object of this invention tends to cancel the above-mentioned fault which a Prior art has.

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**MEANS**

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[Means for Solving the Problem] In the \*\*\* approach of a glass plate of 1st this invention being made the above-mentioned technical problem being solved, and \*(ing) a glass plate along with a \*\*\* projected line While forming the preliminary crack used as the starting point of a rate open circuit in the edge of a glass plate on the \*\*\* projected line of a glass plate With the preliminary crack formation process which adds the bending moment to the surroundings of a \*\*\* projected line immediately after the time of formation of a preliminary crack, or formation, subsequently While advancing a rate open circuit and \*(ing) a glass plate on a \*\*\* projected line by adding local heating near the edge of a rate open circuit The surroundings of a \*\*\* projected line are provided with the \*\*\* approach of the glass plate characterized by what it had the \*\*\* process which adds the bending moment for during progress of a rate open circuit, or immediately after a progress halt.

[0010] The cutting machine of the glass plate characterized by to have the cutting tool which forms [ 2nd ] the preliminary crack used as the starting point of a rate open circuit in a glass plate along with a \*\*\* projected line, a heating means add local heating near the edge of a rate open circuit, the hot-spot migration means, to which relative displacement of a heating means and the glass plate is carried out along with a \*\*\* projected line, and a bending moment energization means give the bending moment to the surroundings of the \*\*\* projected line of a glass plate is offered.

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**OPERATION**

[Function] In this invention, the depth of a preliminary crack can be increased by using the bending moment together to formation of the preliminary crack used as the origin of \*\*\*. Therefore, under a very weak load, only by running a cutting tool, a preliminary crack with sufficient deep depth to produce \*\*\*\*\* can be formed, and generating of glass fines can be controlled in the preliminary crack section.

[0012] Moreover, in order to advance a rate open circuit on a \*\*\* projected line by adding local heating near the trailer of a rate open circuit, adding the bending moment to the surroundings of a \*\*\* projected line, it is hard to produce an uncut portion of a trailer.

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**EXAMPLE**

[Example] Hereafter, the example of this invention is explained according to a drawing.

[0014] Drawing 1 is the perspective view of the fundamental configuration of this invention.

[0015] The glass plate 1 set as the object of \*\*\*\* is laid on the trolley table 7 through the protection sheet 6 with the function of shock absorbing material in order to protect a glass plate from the impact at the time of glass \*\*\*\*. In this example, a hot spot is moved with a trolley table 7. That is, the heating means 4 is being fixed, and when a trolley table moves in the direction of a \*\*\*\* projected line, a glass plate and a heating means are displaced relatively along with a \*\*\*\* projected line.

[0016] Moreover, the bending moment energization means slack wedge 5 is inserted in the glass plate edge of a location which met the \*\*\*\* projected line between a glass plate 1 and the protection sheet 7. Moreover, since the vacuum adsorption of a trolley table 7 is attained and many holes for attraction are opening it on the protection sheet 6, vacuum adsorption of the glass plate 1 is carried out on the protection sheet 6, and the bending moment which met the \*\*\*\* projected line at the glass plate 1 is added. In addition, the bending moment which met the \*\*\*\* projected line depending on the configuration of a wedge can also be added to a glass plate 1 with the self-weight of a glass plate 1.

[0017] In addition, 2 is a cutting tool support press means which carries out actuation which a rate open circuit and 3 support the cutting tool for formation of a preliminary crack, and 8 supports a cutting tool, and is forced on a glass plate by a diagram.

[0018] Although the trolley table 7 was used as a hot-spot migration means in this example, if relative displacement of a heating means and the glass plate is carried out along with a \*\*\*\* projected line, it is good anything. Especially this example fixes a glass plate 1 to reverse, and may move the heating means 4 to it.

[0019] About the heating means 4, laser light, heating air, combustion flame, etc. can be used by independent or compound. Since a high \*\*\*\* precision is acquired, it is desirable to use laser light or combustion flame, such as an excimer laser, an YAG laser, carbon dioxide gas laser, or a carbon monoxide laser. It is desirable to use carbon dioxide laser or combustion flame especially, energy-absorbing effectiveness and since it is economical.

[0020] In this invention, in order not to shift on a \*\*\*\* projected line and to advance a rate open circuit, it is required to carry out partial heating of near the edge of a rate open circuit. For partial heating, it is desirable to lead the source of heating to a predetermined location, and to perform it. Things can be carried out, and when [ which carries out a light guide according to the optical system which consists of a crystal fiber light guide line, a hollow capillary light guide line, and a lens mirror when laser light is used as a heating means 4 ] using heating air, a heat-resistant tube etc. can draw the source of heating by the combustion nozzle, a rubber tube, etc., when using combustion flame.

[0021] About the cutting tool 3, the cutter which sharpened heads, such as a single crystal diamond or a sintered diamond, can be used.

[0022] In order to avoid breakage on a glass plate 1, the wedge used as the protection sheet 6 and a bending moment energization means 5 has the desirable thing of organic macromolecule nature, and the PTFE sheet which has thermal resistance especially, a polyimide resin sheet, its fluorine rubber sheet, etc. are desirable.

[0023] A bending moment energization means should just be established near [ which forms a preliminary crack near the preliminary crack formation part at least ] the edge of a glass plate, and the edge (the

termination of a rate open circuit near [ namely, J) of an opposite direction. By drawing 1 , the wedge 5 is divided and formed in two places (the termination of a rate open circuit near the preliminary crack formation part). Wedge 5a used on the other hand in case it \*\*\*\* to \*\*\*\* projected line 2b and a perpendicular direction is prepared covering full [ of a glass plate ].

[0024] Next, actuation of the equipment of this example is explained. First, a glass plate 1 is laid through the protection sheet 6 and the wedge 5 of a predetermined location on a trolley table 7, and vacuum adsorption is carried out. Subsequently, in the condition, a part for the cutting part of the cutting tool 3 is forced on a glass plate 1 with the cutting tool support press means 8, and preliminary crack 2a which becomes the starting point of the rate open circuit 2 on \*\*\*\* projected line 2b of the edge of a glass plate 1 is formed. Furthermore, partial heating is carried out near the rate open-circuit termination with the heating means 4. In this way, stress concentration is produced with a rate open circuit and heat on a \*\*\*\* projected line, and the rate open circuit 2 is advanced to \*\*\*\* projected line top 2b. Under the present circumstances, along with a \*\*\*\* projected line, relative displacement of the heating means 4 is carried out to a glass plate 1 with a trolley table 7.

[0025] According to the equipment of this invention, about 20–200 gves of formation of the preliminary crack by the cutting tool 3 can be performed by the weak load of \*\*. It is dramatically desirable to perform preliminary crack formation by this \*\*\*\* in the semantics which avoids fines generation of glass. In the above-mentioned example, although the bending moment is simultaneously added at the time of preliminary crack formation, it is after formation of a preliminary crack and the bending moment may be added before partial heating. However, it is more more desirable to form in preliminary crack formation and coincidence in the semantics which shortens the time amount which \*\*\*\* takes.

[0026] In addition, as an approach for making a glass plate 1 generate the bending moment, it is not limited to the approach of this example, but various approaches can be adopted. For example, the approach of performing by pressing down glass with a pressure roll etc. from the rear face or both sides of the approach of generating bending stress, and glass etc. can be used by pressing down both the sides of a wedge with a roll etc.

[0027] Drawing 3 is the side elevation of the pressure roll arrangement at the time of using a pressure roll, and 21–23 show the pressure roll. There is not necessarily no need of preparing all of these pressure rolls, and, as for bending moment addition, at least pressure roll 21 is possible.

[0028] \*\*\*\* was specifically performed as follows. The polyimide resin sheet which prepared the micropore for vacuum attraction in the predetermined part as a protection sheet was pasted up on the trolley table 7 in which vacuum adsorption of 1m angle is possible. Furthermore, as a wedge, the PTFE sheet with die length of 1m, a width of face [ of 1mm ], and a height of 0.2mm was separated from 150mm spacing and both sides 50mm in the x directions, a total of seven trains pasted up, the PTFE sheet with die length of 10mm, a width of face [ of 1mm ], and a height of 0.2mm was separated from 150mm spacing and both sides 50mm only to both ends, and a total of 14 pieces pasted up in the direction of y to them.

[0029] The glass plate with die length of 1m which consists of soda lime glass which performed washing sufficient besides, a width of face [ of 1m ], and a thickness of 0.7mm was carried, vacuum attraction was carried out, and fixed maintenance was carried out. Moving a 3 casks of cutting tools diamond cutter linearly horizontally at the rate of per second 50mm, the cutter was made to go up and down and the end line with a die length of 5mm was put in near the glass edge by about 40g load. By moving the carbon-dioxide-gas-laser beam light which carried out the light guide by the carbon-dioxide-gas-laser hollow capillary light guide line, \*\*\*\* was able to be performed with the above-mentioned end line as the starting point.

[0030] The reinforcement of a carbon-dioxide-gas-laser beam was about 50W in respect of glass. A total of 36 150x150mm glass substrates was obtained by this cutting. Although these substrates were observed under the 200,000 luxs light source all over the dark room, adhesion of the fines of glass was not accepted and the dimensional accuracy of cutting was less than \*\*0.1mm about the perimeter including an origin and an end.

**\* NOTICES \***

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2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

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**DESCRIPTION OF DRAWINGS**

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[Brief Description of the Drawings]

[Drawing 1] The perspective view of the whole equipment concerning the example of this invention

[Drawing 2] The perspective view of a rate open circuit

[Drawing 3] The side elevation of the pressure roll section concerning other examples of this invention

[Description of Notations]

1: Glass plate

2: Rate open circuit

3: Cutting tool

4: Heating means

5: Bending moment energization means

6: Protection sheet

7: Trolley table

11: Preliminary crack

12: Rate open circuit

13: Uncut portion section

21, 22, 23: Pressure roll

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[Translation done.]



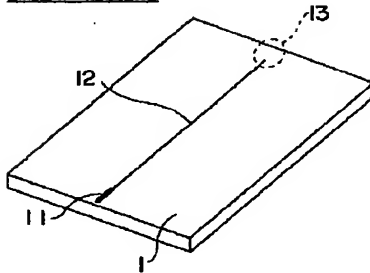
**\* NOTICES \***

**JPO and INPIT are not responsible for any damages caused by the use of this translation.**

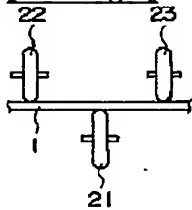
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## DRAWINGS

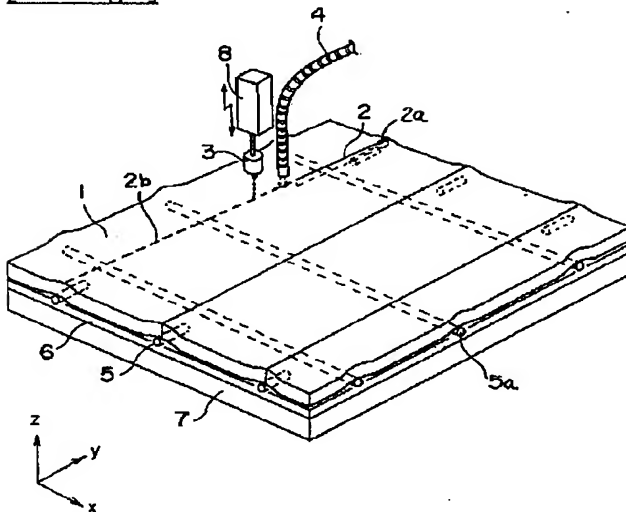
[Drawing 2]



[Drawing 3]



[Drawing 1]



[Translation done.]

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**CORRECTION OR AMENDMENT**

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[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law

[Category partition] The 1st partition of the 3rd category

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[Application number] Japanese Patent Application No. 6-323111

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[Procedure amendment]

[Filing Date] June 19, Heisei 13 (2001. 6.19)

[Procedure amendment 1]

[Document to be Amended] Description

[Item(s) to be Amended] Whole sentence

[Method of Amendment] Modification

[Proposed Amendment]

[Document Name] Description

[Title of the Invention] The \*\*\*\* approach of a glass plate, and equipment for it

[Claim(s)]

[Claim 1] In the \*\*\*\* approach of a glass plate of \*\*\*\*(ing) a glass plate along with a \*\*\*\* projected line,

The preliminary crack formation process which adds the bending moment to the surroundings of a \*\*\*\* projected line immediately after the time of formation of a preliminary crack, or formation while forming the preliminary crack used as the starting point of a rate open circuit in the edge of a glass plate on the \*\*\*\* projected line of a glass plate,

Subsequently, the \*\*\*\* approach of the glass plate characterized by what it had the \*\*\*\* process which adds the bending moment around a \*\*\*\* projected line for during progress of a rate open circuit, or immediately after the progress halt while advancing a rate open circuit and \*\*\*\*(ing) a glass plate on a \*\*\*\* projected line by adding local heating near the edge of a rate open circuit.

[Claim 2] The \*\*\*\* approach of the glass plate according to claim 1 which uses carbon dioxide laser or combustion flame as a source of heating heated locally.

[Claim 3] The \*\*\*\* approach of the glass plate according to claim 1 or 2 performed by cutting formation of a preliminary crack with the load of 200 or less gves, and putting in a line.

[Claim 4] The cutting tool which forms the preliminary crack used as the starting point of a rate open circuit in a glass plate along with a \*\*\*\* projected line,

A heating means to add local heating near the edge of a rate open circuit,

The hot-spot migration means to which relative displacement of a heating means and the glass plate is carried out along with a \*\*\*\* projected line,

The cutting machine of the glass plate characterized by having a bending moment energization means to give the bending moment to the surroundings of the \*\*\*\* projected line of a glass plate.

[Claim 5] A bending moment energization means is the cutting machine of the glass plate according to claim 4 which consists of a pressure roll.

[Claim 6] A bending moment energization means is the cutting machine of the glass plate according to claim 4 which consists of a wedge.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the \*\*\*\* approach of a glass plate, and equipment, and relates to the \*\*\*\* approach of a glass plate and equipment which cannot generate the fines of glass especially easily.

[0002]

[Description of the Prior Art] After cutting cutting of the former and a glass plate, pressing the cutting wheel which consists of cemented carbide etc. by the fixed load and putting in a line, it bends around an end line and the method of applying and \*\*\*\*(ing) the force (bending moment) is taken.

[0003] In order to make it not produce chip box \*\*\*\* of the kind which a rate open circuit cuts and shifts from a line at this time, in case an end line is put in, it is necessary to add a sufficiently big load. Therefore, the lateral crack which advances to abbreviation parallel on the surface of [ other than the median crack which advances in the thickness direction of a glass plate required for cutting originally ] a glass plate arises in the glass surface section, and since this cuts and it exfoliates after the time of line formation, or \*\*\*\*, generating of glass fines is not avoided.

[0004] These glass fines become the cause which adheres to the installation base of glass etc. and attaches a detailed blemish to a glass front face, and also have the problem of the glass fines adhering to a glass front face damaging a glass front face at the time of washing, or giving a blemish on the surface of a glass plate in case the glass fines which were not able to be removed by washing grind the front face of a glass plate, or when a glass plate is piled up.

[0005]

[Problem(s) to be Solved by the Invention] By the way, the method of producing thermal stress by carbon dioxide laser, and \*\*\*\*(ing) glass as the \*\*\*\* approach which glass fines cannot generate comparatively easily, is learned (F. report by P.Gagliano and R.M.Lumley (Proc.of the IEEE, vol.57, no.2, and 1969)). This is known also as an approach of \*\*\*\*(ing) glass in the configuration of arbitration (Japanese Patent Publication No. No. 13040 [ three to ]).

[0006] However, in case it is necessary to form in the edge of a glass plate the preliminary crack which becomes the origin of \*\*\*\* in case a glass plate is \*\*\*\*(ed) and this preliminary crack is formed also by these approaches, the fines of glass arise. Moreover, apart from it, although it is a slight distance, it leaves a part, \*\*\*\* stops and there is a problem that \*\*\*\* does not reach to the edge of objection of a glass plate. At this time, sufficient dimensional accuracy may not be acquired by having folded the glass plate again and having broken it.

[0007] Drawing 2 is the perspective view of a rate open circuit having shown this situation, and shows signs that the rate open circuit 12 was formed with the preliminary crack 11 as the starting point formed in the edge of a glass plate 1. 13 shows the uncut portion section.

[0008] The object of this invention tends to cancel the above-mentioned fault which a Prior art has.

[0009]

[Means for Solving the Problem] This invention is the \*\*\*\* approach of the glass plate which is characterized by providing the following in the \*\*\*\* approach of the glass plate characterized by things and which \*\*\*\* [ 1st ] a glass plate along with a \*\*\*\* projected line. The preliminary crack formation process which adds the bending moment to the surroundings of a \*\*\*\* projected line immediately after the time of formation of a preliminary crack, or formation while forming the preliminary crack used as the starting point of a rate open circuit in the edge of a glass plate on the \*\*\*\* projected line of a glass

plate Subsequently, the \*\*\*\* process which adds the bending moment to the surroundings of a \*\*\*\* projected line during progress of a rate open circuit, or immediately after a progress halt while advancing a rate open circuit and \*\*\*\*(ing) a glass plate on a \*\*\*\* projected line by adding local heating near the edge of a rate open circuit

[0010] The cutting machine of the glass plate characterized by to have the cutting tool which forms [ 2nd ] the preliminary crack used as the starting point of a rate open circuit in a glass plate along with a \*\*\*\* projected line, a heating means add local heating near the edge of a rate open circuit, the hot-spot migration means, to which relative displacement of a heating means and the glass plate is carried out along with a \*\*\*\* projected line, and a bending moment energization means give the bending moment to the surroundings of the \*\*\*\* projected line of a glass plate is offered.

[0011]

[Function] In this invention, the depth of a preliminary crack can be increased by using the bending moment together to formation of the preliminary crack used as the origin of \*\*\*\*. Therefore, under a very weak load, only by running a cutting tool, a preliminary crack with sufficient deep depth to produce \*\*\*\* can be formed, and generating of glass fines can be controlled in the preliminary crack section.

[0012] Moreover, in order to advance a rate open circuit on a \*\*\*\* projected line by adding local heating near the trailer of a rate open circuit, adding the bending moment to the surroundings of a \*\*\*\* projected line, it is hard to produce an uncut portion of a trailer.

[0013]

[Example] Hereafter, the example of this invention is explained according to a drawing.

[0014] Drawing 1 is the perspective view of the fundamental configuration of this invention.

[0015] The glass plate 1 set as the object of \*\*\*\* is laid on the trolley table 7 through the protection sheet 6 with the function of shock absorbing material in order to protect a glass plate 1 from the impact at the time of glass \*\*\*\*. In this example, a hot spot is moved with a trolley table 7. That is, the heating means 4 is being fixed, and when a trolley table 7 moves in the direction of a \*\*\*\* projected line, a glass plate 1 and the heating means 4 are displaced relatively along with a \*\*\*\* projected line.

[0016] Moreover, the 5 casks of bending moment energization means wedge is inserted in the glass plate edge of a location which met the \*\*\*\* projected line between a glass plate 1 and the protection sheet 7. Moreover, since the vacuum adsorption to a glass plate 1 of a trolley table 7 is attained and many holes for attraction are opening it on the protection sheet 6, vacuum adsorption of the glass plate 1 is carried out on the protection sheet 6, and the bending moment which met the \*\*\*\* projected line at the glass plate 1 is added. In addition, the bending moment which met the \*\*\*\* projected line depending on the configuration of a wedge can also be added to a glass plate 1 with the self-weight of a glass plate 1.

[0017] In addition, 2 is a cutting tool support press means which carries out actuation which a rate open circuit and 3 support the cutting tool for formation of a preliminary crack, and 8 supports a cutting tool, and is forced on a glass plate 1 by a diagram.

[0018] Although the trolley table 7 was used as a hot-spot migration means in this example, if relative displacement of the heating means 4 and the glass plate 1 is carried out along with a \*\*\*\* projected line, it is good anything. Especially this example fixes a glass plate 1 to reverse, and may move the heating means 4 to it.

[0019] About the heating means 4, laser light, heating air, combustion flame, etc. can be used by independent or compound. Since a high \*\*\*\* precision is acquired, it is desirable to use laser light or combustion flame, such as an excimer laser, an YAG laser, carbon dioxide laser, or a carbon monoxide laser. It is desirable to use carbon dioxide laser or combustion flame especially, energy-absorbing effectiveness and since it is economical.

[0020] In this invention, in order not to shift on a \*\*\*\* projected line and to advance a rate open circuit, it is required to carry out partial heating of near the edge of a rate open circuit. For partial heating, it is desirable to lead the source of heating to a predetermined location, and to perform it. When a light guide can be carried out and it uses heating air according to the optical system which consists of a crystal fiber light guide line, a hollow capillary light guide line, and a lens mirror when laser light is used as a heating means 4, a heat-resistant tube etc. can draw the source of heating by the combustion nozzle, a rubber tube, etc., when using combustion flame.

[0021] About the cutting tool 3, the cutter which sharpened heads, such as a single crystal diamond or a

sintered diamond, can be used.

[0022] In order to avoid breakage on a glass plate 1, the wedge used as the protection sheet 6 and a bending moment energization means 5 has the desirable thing of organic macromolecule nature, and the PTFE sheet which has thermal resistance especially, a polyimide resin sheet, its fluorine rubber sheet, etc. are desirable.

[0023] The bending moment energization means 5 should just be established near [ which forms a preliminary crack near the preliminary crack formation part at least ] the edge of a glass plate, and the edge (the termination of a rate open circuit near [ namely, ]) of an opposite direction. By drawing 1, the wedge which is the bending moment energization means 5 is divided and formed in two places (the termination of a rate open circuit near near the preliminary crack formation part). The wedge which is bending moment energization means 5a used on the other hand in case it \*\*\*\* to \*\*\*\* projected line 2b and a perpendicular direction is formed covering full [ of a glass plate ].

[0024] Next, actuation of the equipment of this example is explained. First, a glass plate 1 is laid through the protection sheet 6 and the wedge of a predetermined location on a trolley table 7, and vacuum adsorption is carried out. Subsequently, in the condition, a part for the cutting part of the cutting tool 3 is forced on a glass plate 1 with the cutting tool support press means 8, and preliminary crack 2a which becomes the starting point of the rate open circuit 2 on \*\*\*\* projected line 2b of the edge of a glass plate 1 is formed. Furthermore, partial heating is carried out near the rate open-circuit termination with the heating means 4. In this way, stress concentration is produced with a rate open circuit and heat on a \*\*\*\* projected line, and the rate open circuit 2 is advanced to \*\*\*\* projected line top 2b. Under the present circumstances, along with a \*\*\*\* projected line, relative displacement of the heating means 4 is carried out to a glass plate 1 with a trolley table 7.

[0025] According to the equipment of this invention, formation of the preliminary crack by the cutting tool 3 can be performed by the load with weak 20 - 200gf extent. It is dramatically desirable to perform preliminary crack formation by this \*\*\*\* in the semantics which avoids fines generation of glass. In the above-mentioned example, although the bending moment is simultaneously added at the time of preliminary crack formation, it is after formation of a preliminary crack and the bending moment may be added before partial heating. However, it is more more desirable to form in preliminary crack formation and coincidence in the semantics which shortens the time amount which \*\*\*\* takes.

[0026] In addition, as an approach for making a glass plate 1 generate the bending moment, it is not limited to the approach of this example, but various approaches can be adopted. For example, the approach of performing by pressing down glass with a pressure roll etc. from the rear face or both sides of the approach of generating bending stress, and glass etc. can be used by pressing down both the sides of a wedge with a roll etc.

[0027] Drawing 3 is the side elevation of the pressure roll arrangement at the time of using a pressure roll, and 21-23 show the pressure roll. There is not necessarily no need of preparing all of these pressure rolls, and, as for bending moment addition, at least pressure roll 21 is possible.

[0028] \*\*\*\* was specifically performed as follows. The polyimide resin sheet which prepared the micropore for vacuum attraction in the predetermined part as a protection sheet was pasted up on the trolley table 7 which the plate of the size of 1m angle can vacuum adsorb. Furthermore, as a wedge, at intervals of 150mm, the PTFE sheet with die length of 1m, a width of face [ of 1mm ], and a height of 0.2mm was separated from the both sides of a trolley table 7 50mm, and was pasted up in the x directions a total of seven trains, the PTFE sheet with die length of 10mm, a width of face [ of 1mm ], and a height of 0.2mm be separated from the both sides of a trolley table 7 50mm at intervals of 150mm only to both ends, and a total of 14 pieces pasted up in the direction of y to them.

[0029] The glass plate with die length of 1m which consists of soda lime glass which performed washing sufficient besides, a width of face [ of 1m ], and a thickness of 0.7mm was carried, vacuum attraction was carried out, and fixed maintenance was carried out. Moving a 3 casks of cutting tools diamond cutter linearly horizontally at the rate of per second 50mm, the cutter was made to go up and down and the end line with a die length of 5mm was put in near the glass edge by about 40g load. By moving the carbon-dioxide-gas-laser beam light which carried out the light guide by the carbon-dioxide-gas-laser hollow capillary light guide line, \*\*\*\* was able to be performed with the above-mentioned end line as the starting point.

[0030] The reinforcement of a carbon-dioxide-gas-laser beam was about 50W in respect of glass. A total

or 30 150x150mm glass substrates was obtained by this cutting. Although these substrates were observed under the 200,000 luxs light source all over the dark room, adhesion of the fines of glass was not accepted and the dimensional accuracy of cutting was less than  $\pm 0.1$ mm about the perimeter including an origin and an end.

[0031]

[Effect of the Invention] The following effectiveness is attained by this invention.

[0032] 1) It is obtained, without performing washing with a special glass substrate with little adhesion of glass fines, since there is very little generating of the glass fines after the time of cutting and cutting.

[0033] 2) Since the blemish generated at the polish process of a glass substrate decreases, polish floor to floor time can be shortened.

[0034] 3) Compared with the case where the bending moment is not used together, high-speed cutting is attained by the high yield.

[0035] 4) Since an uncut portion does not arise, cutting of close dimensional accuracy can be performed.

[0036] 5) Since a micro crack does not exist in a cutting plane, the mechanical strength of glass is high, and since washing residue cannot remain easily, it is easy to acquire the clean surface.

[0037] 6) Since grinding fluid etc. does not adhere, it is not necessary to wash glass.

[0038] According to this invention, it can cut with the sufficient yield, without damaging glass also about the thin glass 0.2mm or less which an end line could not put in easily.

[0039] 7) If this invention is used when manufacturing the substrate for liquid crystal display components (LCD) especially, it is very effective. that is, since glass fines hardly arise at the time of \*\*\*\*, a foreign matter remains on a liquid crystal display component substrate, and the situation which the irregular color which boils and depends an electric short circuit and the fluctuation in a substrate of liquid crystal layer thickness generates can be prevented.

[Brief Description of the Drawings]

[Drawing 1] The perspective view of the whole equipment concerning the example of this invention

[Drawing 2] The perspective view of a rate open circuit

[Drawing 3] The side elevation of the pressure roll section concerning other examples of this invention

[Description of Notations]

1: Glass plate

2: Rate open circuit

3: Cutting tool

4: Heating means

5: Bending moment energization means

6: Protection sheet

7: Trolley table

11: Preliminary crack

12: Rate open circuit

13: Uncut portion section

21, 22, 23: Pressure roll

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[Translation done.]